Theoretically Driven Workplace Intervention for the Promotion of Cervical Cancer Screening: Application of the Extended Parallel Process Model

ABSTRACT

Aim: To develop and evaluate an EPPM-based educational intervention to improve women's intentions to undergo cervical cancer screening and increase Pap smear uptake.

Methods: A non-randomized quasi-experimental cluster comparison was conducted with 120 female schoolteachers from two randomly selected cities in Kermanshah Province, Iran. Participants were assigned to either the experimental group (n = 60) or the control group (n = 60). A two-stage sampling approach was used. Data was collected using a validated questionnaire based on the EPPM. The experimental group participated in a four-session educational intervention. Follow-up data were collected two months after the intervention. Data analysis was performed using SPSS version 16.

Findings: At baseline, all participants in both groups were in the fear control process. Two months post-intervention, 43.3% of the experimental group had transitioned to danger control, compared to just 1.7% in the control group—a statistically significant difference ($P<0.001$). Post-intervention results demonstrated significant increases in all construct mean scores as well as behavioral intentions within the experimental group ($P<0.001$). However, only 2 participants in the experimental group ultimately underwent Pap smear testing, showing no significant change from pre-intervention levels ($P=0.154$).

Conclusion: The theory-based educational intervention improved perceived self-efficacy, perceived threat, and behavioral intentions toward cervical cancer screening; however, further research is needed to identify barriers to Pap smear uptake and develop more effective screening promotion strategies.

Keywords: Cervical Cancer, Screening, Pap Smear Test, Education, Extended Parallel Process Model.

In Press

Introduction

Cervical cancer ranks as the fourteenth most common cancer overall and represents the fourth most frequent cancer among women worldwide [1]. In 2022, approximately 660,000 new cervical cancer cases and nearly 350,000 deaths were recorded globally, with the highest incidence occurring in low- and middle-income countries [2]. The World Health Organization (WHO) reported in 2021 that the annual incidence rate of cervical cancer in Iran was 2.5 per 100,000 women, with approximately 500 attributed deaths [3].

Cervical cancer remains one of the most preventable and treatable malignancies [4]. Both HPV vaccination and regular screening constitute critical measures for addressing the growing challenge of cervical cancer and associated mortality [5, 6]. The Pap smear test, as the most common screening method for cervical cancer, serves as an essential healthcare component [7]. The implementation of this test has significantly impacted cervical cancer mortality rates, reducing them by 70-80% worldwide and by nearly 90% in developing countries [8, 9].

However, adherence to regular Pap smear test screening remains low among Iranian women, as demonstrated by multiple studies [10, 11]. Research identifying barriers to Pap smear testing in Iran has consistently highlighted several major obstacles: low perceived susceptibility to cervical cancer, fear of the Pap smear test, and limited understanding of both the importance and effectiveness of Pap smear in cervical cancer prevention [11-13]. Notably, few Iranian studies have examined the impact of educational interventions in addressing these barriers. Furthermore, no studies focusing on workplace health promotion interventions [such as those targeting female teachers in school settings] to promote Pap smear testing were identified. Existing research has primarily examined women attending health centers [14-17], leaving a significant gap in knowledge about alternative intervention settings. Recent evidence from a scoping review confirms that educational interventions—including group discussions, lectures, and educational pamphlets—effectively address barriers to cervical cancer prevention [18]. Moreover, theory-based interventions that incorporate cultural adaptation have demonstrated positive impacts on cervical cancer preventive behaviors [18-19]. Behavior change theories offer valuable frameworks by (1) identifying key factors influencing health behaviors, (2) clarifying relationships between these factors, and (3) providing robust guidance for designing purposeful educational interventions aimed at improving, maintaining, and promoting health behaviors [20].

Numerous behavior change theories exist at the individual level. Among these, the Extended Parallel Process Model (EPPM), developed by Kim Witte in 1992, stands out as one of the most frequently utilized theories for directly addressing Pap smear testing barriers from a health communication perspective. The EPPM provides a framework for understanding health behaviors through threat and efficacy appraisals, comprising four core constructs: (1) perceived susceptibility, (2) perceived severity, (3) perceived self-efficacy, and (4) perceived response efficacy. According to the EPPM, fear-arousing messages initiate dual appraisal processes of threat and efficacy. The model posits that when individuals perceive a substantial threat but also believe in their capacity to manage it (high efficacy), they are more likely to adopt protective behaviors (danger control process). Conversely, when individuals perceive high threat but doubt their ability to cope or question the effectiveness of preventive measures (low efficacy), they may resort to avoidance or denial (fear control process). The crisis point refers to a conceptual threshold in the EPPM at which perceived threat exceeds perceived efficacy, prompting a shift toward the fear control process. To operationalize this concept, the crisis point score is calculated by subtracting the mean perceived efficacy score from the mean perceived threat score. A score below zero indicates that the individual is in the fear control process, whereas a score above zero indicates that the individual is in the danger control process [21, 22]. In the case of cervical cancer, on one hand, women must perceive themselves as at risk for cervical cancer (perceived susceptibility) and recognize the seriousness of the associated risk (perceived severity). On the other hand, they must have confidence in their ability to undergo Pap smear screening (perceived self-efficacy) and believe in the effectiveness of the recommended screening method (perceived response-efficacy). According to the EPPM, for women to engage in screening behavior, their perceived efficacy (the sum of self-efficacy and response-efficacy) must be higher than their perceived threat (the sum of susceptibility and severity). (Diagram 1).

Kermanshah, the largest province in western Iran, includes underprivileged cities and areas such as Islamabad-e Gharb and Sarpol-e Zahab, which face significant health challenges and lack adequate educational facilities, adversely affecting the well-being of their residents [23]. Women's health is widely recognized as a crucial indicator of physical, mental, and social well-being [24]. Given the important role female teachers play in influencing and motivating the next generation of women, this study was designed to evaluate the impact of an educational intervention on cervical cancer screening among female teachers in Kermanshah Province, using the EPPM as the theoretical framework.

In Press

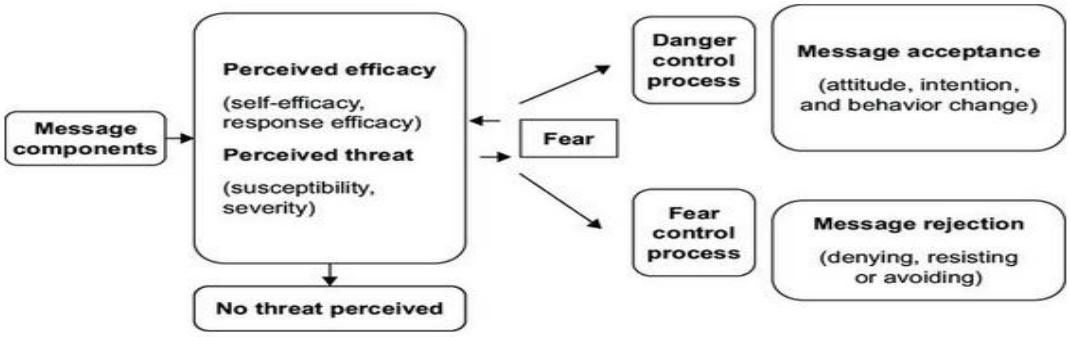


Diagram 1. A Schematic View of the Extended Parallel Process Model

Materials & Methods

Study Design, Populatic

This non-randomized q Kermanshah Province, western Iran, focusing on secondary school teachers. Eligible participants were married teachers with at least six months of marriage. We excluded those who (1) had undergone Pap smear testing within the previous year, (2) had a history of hysterectomy or cervical cancer, or (3) being in the danger control process at baseline, as indicated by a crisis point score greater than zero (The crisis point score was calculated by subtracting the mean perceived efficacy score from the mean perceived threat score). The sample size was determined using the formula for comparing the means of two independent groups:

$$N = \frac{\left[Z_{\left(1-\frac{a}{2}\right)} + Z_{(1-\beta)}\right]^2 \left(\sigma_1^2 + \sigma_2^2\right)}{\Delta^2}$$

In this formula, σ represents the estimated standard deviation of behavioral intention in each group, and Δ denotes the minimum clinically important difference between the two groups. Based on the parameters of α=0.05 (Z1−α/2=1.96), a power of 90% (Z1−β=1.28), σ1=σ2=1, and an effect size (Δ) of 0.45 σ, the sample size was calculated to be 52 participants per group. Considering a 15% attrition rate, the final sample size was set at 60 participants per group.

To minimize the risk of contamination between the intervention and control groups, the control group was selected from a separate city. Therefore, Islamabad-e Gharb (experimental group) and Sarpol-e Zahab (control group) were selected because of their similar cultural and socioeconomic characteristics, with the aim of minimizing potential contextual differences between the two groups. The sampling procedure was conducted in two stages. First, cluster random sampling was performed, followed by convenience sampling. First, all girls' secondary schools in each city were considered eligible clusters. A complete list of eligible schools was prepared for each city, and seven schools from each city (14 schools in total) were selected through a lottery-based random sampling procedure. The selection of schools was guided by two considerations: the estimated proportion of teachers involved in the fear control process (approximately 51%), based on previous research [25], and the typical number of teachers per school (15–25). In the second stage, convenience sampling was used to recruit participants. All eligible teachers in the selected schools who voluntarily agreed to participate were enrolled in the study. (Figure 2; Diagram 2).

In Press

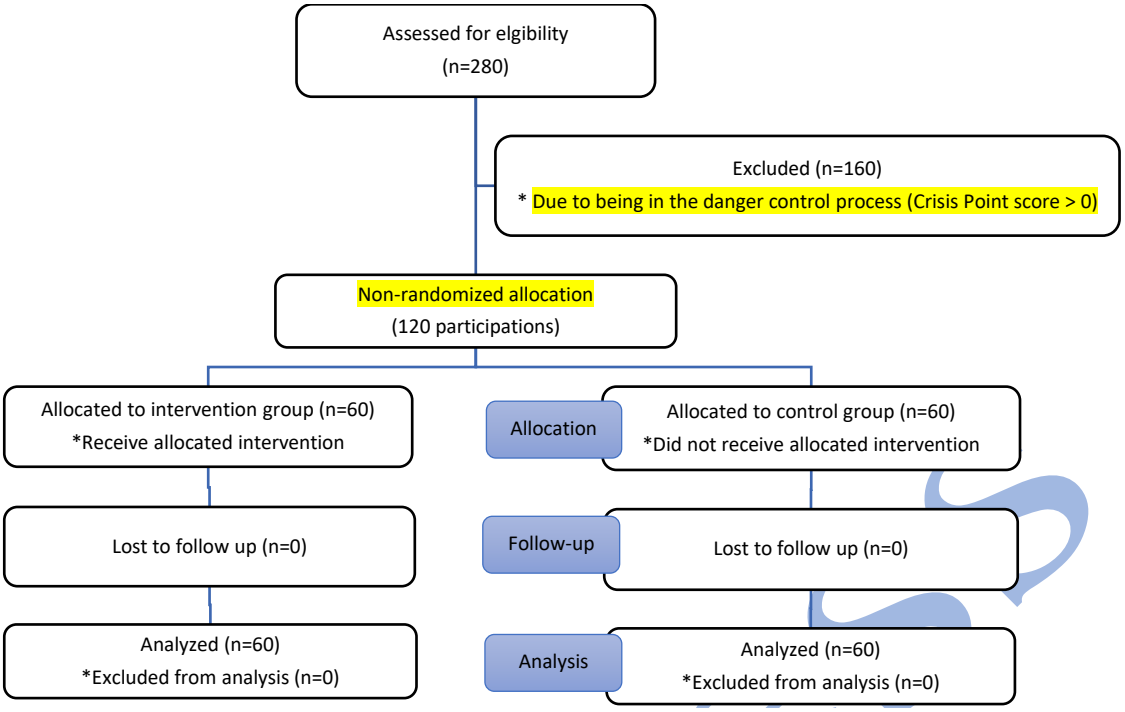


Diagram 2. CONSORT flow diagram of the study

Data Collection Instrument, Validity, and Reliability

A researcher-made questionnaire was used for data collection. The questionnaire consisted of three sections:

- **Section 1: Demographic Information**

This section collected information on sociodemographic variables, including age, marital status, age at marriage, family medical history, educational level, and field of study.

- **Section 2: Constructs of the Extended Parallel Process Model**

This section contained 12 items assessing the EPPM constructs, with three items dedicated to each of the following dimensions: perceived severity (e.g., "I believe that if I get cervical cancer, it will disrupt my relationship with my husband"), perceived susceptibility (e.g., "There is a possibility that I could get cervical cancer"), perceived response efficacy (e.g., "The Pap smear test can be one of the best ways to detect cervical cancer early"), and perceived self-efficacy (e.g., "Despite my busy schedule, I can make time for a Pap smear test"). All EPPM construct items were measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The score for each EPPM construct ranged from 3 to 15, while the total score for the questionnaire ranged from 12 to 60.

- **Section 3: Behavioral Intention and Behavior**

This section comprised two components: (1) behavioral intention, assessed through two items (e.g., "I intend to have a Pap smear test regularly—once a year for the next 3 years, or every 3 years") using a 3-point Likert scale (1 = disagree, 2 = neutral, 3 = agree); and (2) actual behavior, measured by a single dichotomous yes/no item ("Have you ever had a Pap smear test?").

To establish the validity of the instrument, the EPPM-based questionnaire was reviewed by 10 experts in health education, health promotion, and gynecology. The experts evaluated each item in terms of necessity, importance, simplicity, and clarity. Following their feedback, the Content Validity Ratio (CVR) was calculated for all items. Based on the standard thresholds established for 10 experts (26, 27), items with a CVR below 0.62 or a Content Validity Index (CVI) below 0.79 were excluded. CVR values ranged from 0.68 to 0.94 for the EPPM scale, while the corresponding values were 0.80 for behavioral intention and 0.82 for screening behavior. The Scale-level Content Validity Index (S-CVI) was 0.92 for the overall EPPM scale, 0.94 for behavioral intention, and 0.90 for screening behavior. At the construct level, the S-CVI values were 0.91 for perceived susceptibility, 0.92 for perceived severity, 0.90 for perceived response efficacy, and 0.94 for perceived self-efficacy. The internal consistency of the EPPM scale was assessed using Cronbach's alpha. The coefficients were 0.79 for perceived susceptibility, 0.78 for perceived severity, 0.90 for perceived response efficacy, and 0.91 for perceived self-efficacy, with an overall Cronbach's alpha of 0.85. Test–retest reliability was evaluated using the intraclass correlation coefficient (ICC). The ICC values were 0.86 for perceived susceptibility, 0.86 for perceived severity, 0.90 for perceived response efficacy, and 0.92 for perceived self-efficacy. The overall EPPM scale demonstrated an ICC of 0.90.

Procedure (Educational Intervention)

After conducting the pre-test and needs assessment, the educational intervention was designed and implemented for the experimental group within the school setting. With coordination from the school principals, the sessions were held in the meeting rooms of each school. Each session included all participants from that school, with group sizes ranging from 8 to 12 teachers. The control group did not receive any intervention. Two months after the intervention ended, a post-test was administered to both groups. To encourage consistent participation throughout the study, school principals regularly attended the sessions. Additionally, participants in both groups received small gifts as tokens of appreciation for their involvement. The intervention, including the methods and educational materials used, is described as follows:

1) **Printed Educational Material:** An educational pamphlet was developed to raise awareness among women about cervical cancer, the Pap smear test, and the benefits of screening. To encourage participation, the pamphlet featured attention-grabbing headlines such as "You may be at risk for cervical cancer" and "How aware are you of your risk for this cancer?" The content covered key topics including "What is cervical cancer?", "What are the causes and symptoms of cervical cancer?", "What is a Pap smear test?", "Why is a Pap smear test important?", "When should a Pap smear test be done?", and "Where can I get this test done?" Before distribution, the pamphlet was reviewed by a team of five health experts, including two Ph.D. specialists in health education and promotion, a midwife, a public health specialist, and a master's student in health education. To ensure the material was appropriate for the target audience's educational level, an expert from Kermanshah's education department also reviewed it. Based on their feedback, the content was revised accordingly. Finally, the pamphlet was pilot-tested with 10 teachers (not involved in the main study) to assess its readability and clarity. (Figure 1). (Note: The pamphlet was developed and validated in Persian. The English translation is provided here solely to inform readers of its content. The original version is included in Supplementary File 3.)

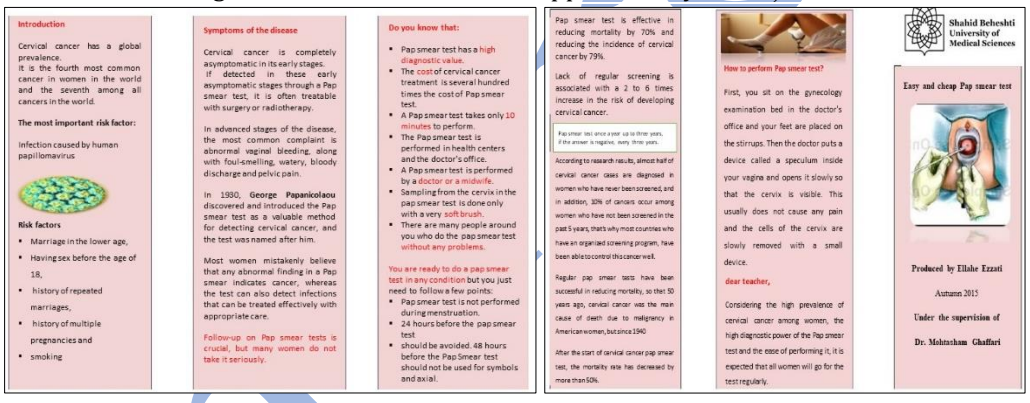


Figure 1. A Visual Representation of the Educational Pamphlet

2) **Educational Sessions:** The educational intervention was designed based on the pre-test findings and conducted over four 30-minute sessions. Active learning methods, including lectures, group discussions, and question-and-answer sessions, were used throughout. The first and second sessions focused on increasing perceived threat by providing information on epidemiology, symptoms, risk factors, and complications of cervical cancer through lectures and Q&A. In the third and fourth sessions, the focus shifted to enhancing perceived efficacy. Participants were educated about the importance of early detection, screening methods, and cervical cancer screening guidelines using lectures, group discussions, and Q&A. Additionally, during the third session, an educational video was shown to improve women's perceived efficacy regarding the Pap smear test. The video clearly explained the benefits of cervical cancer screening and demonstrated the screening process in simple terms. To further increase perceived threat, teachers were encouraged to share their positive or negative experiences and feelings about cervical cancer. To promote appraisal of efficacy and engagement in the danger control process, teachers with a history of regular cervical cancer screening were invited to share their positive experiences with the group. Following these testimonials, participants engaged in group discussions about the effectiveness of the Pap smear test in preventing cervical cancer, its affordability, and the time required to complete it. They also discussed how the test can detect not only cervical cancer but also infections and inflammation. Techniques such as teach-back, Q&A, encouraging participants to explain

concepts in their own words, and sharing personal stories were used to foster active and meaningful participation. (Table 1)

Table 1. Summary of the Educational Intervention

Session	Objectives	Teaching Method	Instructional Materials	Duration (Minutes)
1	Increasing perceived susceptibility	Lecture	PowerPoint Slides	30
2	Increasing perceived severity	Lecture, Q & A	PowerPoint Slides	30
3	Increasing perceived response efficacy	Lecture, Group Discussion	PowerPoint Slides, Pamphlet, Video Clip	30
4	Increasing perceived self-efficacy	Lecture, Q & A, Group Discussion	PowerPoint Slides, Pamphlet	30

Data Analysis

Data were analyzed using SPSS version 16. The Kolmogorov-Smirnov test was used to assess the normality of data distribution. For normally distributed variables, parametric tests were applied: the independent t-test for between-groups comparisons and the paired t-test for within-group comparisons. For variables that were not normally distributed, non-parametric tests were used: the Mann-Whitney U test for between-group comparisons and the Friedman test for within-group comparisons. To compare demographic variables, which were nominal or ordinal, the chi-square test was employed. Descriptive statistics, including frequencies, were used to assess participants' status regarding the danger control process. All participants provided complete responses to the questionnaire, and no missing data were identified in the study.

Findings

A total of 280 female secondary school teachers who met the initial eligibility criteria were assessed at baseline. Following the baseline assessment, participants' responses were evaluated based on the EPPM crisis-point criterion. Of these, 160 participants who obtained scores greater than zero, indicating that they had entered the danger control process, were excluded from further participation. Consequently, 120 female secondary school teachers were included in the study. The mean age of participants was 38.63 ± 6.7 years, and the mean age at marriage was 21.66 ± 3.81 years. Regarding education levels, 4 teachers held a high school diploma, 15 had an associate degree, 78 held a bachelor's degree, and 23 had a master's degree or higher. In terms of fields of study, 15 teachers specialized in chemistry, 27 in mathematics, and 78 in other fields (Table 2).

Table 2. Demographic characteristics of participants in experimental and control groups

Variable		Experimental Group (n = 60)		Control Group (n = 60)		Significance level
		N	%	N	%	
Age	20-25	1	1.67	0	0.00	0.431
	25-30	5	8.33	9	15.00	
	30-35	9	15.00	8	13.33	
	35-40	15	25.00	13	21.67	
	40-45	17	28.33	17	28.33	
	45-50	8	13.33	11	18.33	
	50-55	5	8.33	2	3.33	
Age at marriage	14-20	25	41.67	30	50.00	0.107
	20-25	25	41.67	24	40.00	
	25-30	6	10.00	3	5.00	
	30-35	4	6.67	3	5.00	
Marital status	Married	57	95.00	56	93.33	0.382
	Divorced	2	3.33	2	3.33	
	Widow	1	1.67	2	3.33	
History of cervical cancer in close family	Yes	4	6.67	2	3.33	0.371
	No	56	93.33	58	96.67	
Education level	Diploma	0	0.00	4	6.67	0.158

In Press

	Post graduate	9	15.00	6	10.00	
	Bachelor's degree	41	68.33	37	61.67	
	Master's degree	10	16.67	13	21.67	
Field of study	Chemistry	8	13.33	7	11.67	0.943
	Math	13	21.67	14	23.33	
	Other	39	65.00	39	65.00	

According to the results presented in Table 3, following the educational intervention, significant between-group differences were observed in the mean scores of all four Extended Parallel Process Model (EPPM) constructs: perceived susceptibility ($p = 0.024$), perceived severity ($p = 0.003$), perceived response efficacy ($p < 0.001$), and perceived self-efficacy ($p < 0.001$). Furthermore, within-group comparisons showed that the scores of all four constructs increased significantly from pre-intervention to post-intervention in the experimental group ($p<0.001$), whereas no statistically significant changes were observed in the control group. In addition, the ANCOVA results demonstrated that statistically significant between-group differences in all four EPPM constructs remained after adjustment for baseline scores ($p<0.001$). These findings indicate that the educational intervention was effective in improving the cognitive and perceptual constructs of the EPPM, with the largest adjusted differences observed for perceived self-efficacy (6.03; 95% CI: 5.52–6.54; $p < 0.001$) and perceived response efficacy (5.14; 95% CI: 4.61–5.67; $p < 0.001$) and the smallest for perceived susceptibility (1.03; 95% CI: 0.70–1.36; $p < 0.001$).

Table 3. Pre- and post-intervention comparative results of the EPPM constructs in experimental and control groups

Construct	**Group**	**Pre-Intervention Mean (SD)**	**Post-Intervention Mean (SD)**	***Within-group P-value**	**Effect Estimate**	**95% CI**	****ANCOVA P-value**
Perceived susceptibility	Experimental	13.38 (1.26)	14.45 (0.83)	<0.001	1.03	0.70-1.36	<0.001
	Control	13.06 (1.13)	13.02 (1.32)	0.066			
	Between-group P-value	0.229	0.024	-	-	-	-
Perceived severity	Experimental	13.21 (1.13)	14.30 (0.80)	<0.001	1.20	0.81-1.57	<0.001
	Control	12.86 (1.37)	12.61 (1.30)	0.059			
	**Between-group P-value	0.153	0.003	-	-	-	-
Perceived response efficacy	Experimental	8.80 (2.20)	13.56 (1.2)	<0.001	5.14	4.61-5.67	<0.001
	Control	8.18 (2.24)	8.03 (2.59)	0.487			
	**Between-group P-value	0.071	<0. 001	-	-	-	-
Perceived self-efficacy	Experimental	7.18 (2.07)	13.2 (1.57)	<0.001	6.03	5.52-6.54	<0.001
	Control	6.88 (2.35)	6.98 (2.31)	0.229			
	**Between-group P-value	0.609	<0. 001	-	-	-	-

Results of paired-samples t-test* and independent-samples t-test**

Results of ANCOVA ***

Table 4 presents the mean ranks for behavioral intention and behavior in both groups before and after the intervention. For behavioral intention, the mean rank in the experimental group increased significantly from 62.65 to 77.72 ($p < 0.001$), whereas in the control group it decreased from 58.35 to 43.28, which was not statistically significant ($p = 0.180$). The Mann–Whitney U test showed a significant between-group difference in post-intervention mean ranks ($p < 0.001$). For behavior, the mean rank in the experimental group increased slightly from 60.50 to 61.50, which was not statistically significant ($p = 0.250$). Based on the Mann–Whitney U test, the between-group difference in post-intervention mean ranks was also not significant ($p = 0.156$).

Table 4. Pre- and post-intervention results of mean rank in experimental and control groups' behavioral intention

Behavioral intention	Behavior

In Press

	Pre-Intervention	Post-Intervention	P-value*	Pre-Intervention	Post-Intervention	P-value*** (Exact Sig.)
	Mean Rank	Mean Rank		Mean Rank	Mean Rank	
Experimental Group	62.65	77.72	<0.001	60.50	61.50	0.250
Control Group	58.35	43.28	0.180	60.50	59.50	1.000
P-value**	0.461	<0. 001		1.000	0.156	

*Wilcoxon test results, **Mann-Whitney U test results, ***McNemar test

Before the intervention, all teachers in both experimental and control groups were in the fear control process. Following the intervention, the number of participants remaining in the fear control process significantly decreased to 34 (56.7%) in the experimental group, compared to 59 (98.3%) in the control group (P < 0.001) (Table 5). Moreover, 26 participants (43.3%) in the experimental group shifted to the danger control process after the intervention, whereas only 1 participant (1.7%) did in the control group, a difference that was also statistically significant (P < 0.001) (Figure 2).

Table 5. Frequency distribution of fear control and danger control processes in experimental and control groups

	Pre-Intervention		**Post-Intervention**			
	Fear control process		Fear control process		Danger control process	
	N	%	N	%	N	%
Experimental Group (n = 60)	60	100	34	56.7	26	43.3
Control Group (n = 60)	60	100	59	98.3	1	1.7
P-value			<0.001			



Figure 2. Fear control and danger control processes in experimental and control groups before and after the intervention

Discussion

The primary aim of this study was to evaluate the effectiveness of an educational intervention based on the EPPM in promoting cervical cancer screening behavior among female teachers in Kermanshah Province. The findings provide valuable insights into the intervention's effects on EPPM constructs and underscore the need to address existing barriers to cervical cancer screening.

The results showed a statistically significant increase in the proportion of participants who shifted from the fear control process to the danger control process in the experimental group compared to the control group following the intervention. This shift may indicate changes in participants' responses to fear-inducing messages. According to the EPPM, when individuals perceive a threat but also believe they have the capability to manage it effectively, they engage in efficacy appraisal, leading to adaptive responses and successful threat management [28, 29).

The findings revealed a significant increase in perceived severity and perceived susceptibility scores in the experimental group following the educational intervention. These results are consistent with previous studies by Khoshnezar et al. [30], Sharifipour et al. [31], Eghbal et al. [32], and El Sayed et al. [33]. This consistency may be attributed to similarities in the target populations, and similarities in content delivery methods, including lectures, educational pamphlets, and question-and-answer sessions. These changes may reflect an improvement in participants' perceived understanding of cervical cancer-related risks

following the educational sessions. Specifically, presenting statistical data, scientific evidence, and clear information about risk factors and consequences—such as the physical, psychological, social, economic, and occupational impacts of cervical cancer—can increase women's perceived threat. This heightened perception of threat may serve as a key motivator for adopting preventive health behaviors.

This study also demonstrated a significant improvement in the perceived self-efficacy of participants in the experimental group following the intervention. This improvement may be related to intervention components such as shared experiences of teachers who had previously undergone Pap smear testing and group discussions addressing common screening barriers. These findings are consistent with those of Zhang et al. [34] and Mohammad et al. [35], whose studies, like the present study, employed theory-based interventions and similar study designs. Similarly, Bunkarn et al. [36] found that interventions focused on enhancing self-efficacy significantly improved cervical cancer screening rates. Shin et al. [37] also identified self-efficacy as a key factor influencing women's participation in cervical cancer screening programs.

Another important finding was that the mean score for perceived response efficacy significantly increased in the experimental group compared to the control group following the educational intervention. This result is consistent with the findings of Khaldenazhad et al. [38], which, similar to the present study, was conducted in the Iranian community context and focused on Pap smear testing. Similarly, studies by Asadi et al. [39] and Li et al. [40] have shown that perceived response efficacy plays a key role in encouraging women to undergo Pap smear testing. The observed improvement in perceived response efficacy among the participating teachers underscores the value of implementing educational sessions for this group. Since one of the main barriers to participating in screening behaviors—such as Pap smear tests—is a lack of belief in the effectiveness of these methods for early detection [11–13], interventions aimed at addressing these misconceptions can be effective in promoting such behaviors. Therefore, greater emphasis should be placed on this construct when developing educational materials.

Another finding of the study was a significant increase in the intention to undergo a Pap smear test among teachers in the intervention group. These results align with the findings of previous studies conducted by Khany et al. [41], Mahboobi et al. [42], and Mboineki et al. [43]. The consistency of findings across these studies may be partly explained by similarities in the sociocultural and religious contexts of the study populations, as well as the use of theory-based frameworks to guide the design of the interventions.

Based on the results, Although the intervention was associated with significant improvements in EPPM-related constructs and behavioral intention, these changes did not result in a statistically significant increase in actual Pap smear uptake during the two-month follow-up period. This finding is in alignment with the study by Mohammadi et al. [44], but it contrasts with the results reported by Khaldenjad et al. [38] and Ayanto et al. [45], who found a significant increase in screening rates following similar interventions. The follow-up period in the aforementioned studies was six months, which provided a longer opportunity for behavioral intention to translate into actual screening behavior compared with the two-month follow-up period in the present study. Furthermore, participant recruitment and intervention delivery in these studies took place in healthcare centers. Therefore, participants may have been more motivated and ready to undergo Pap smear testing due to their engagement with healthcare services. In addition, in the study by Ayanto et al., part of the intervention involved the husbands of the women participants. Thus, husbands' support and encouragement may have played a role in facilitating and reinforcing screening behavior. Overall, differences in follow-up duration, intervention settings, and the extent of social support may partly explain the discrepancies between the findings of these studies and those of the present study. Two possible explanations may account for the lack of behavioral change. First, participation in screening is influenced by multiple factors, including individual characteristics, social norms, lack of recommendations from healthcare providers, and other barriers [11–13]. These factors may have limited the effectiveness of the intervention in changing behavior among the teachers. Second, the short follow-up period—only two months—may not have been sufficient to capture actual behavioral change. Due to the nature of the behavior being studied, a longer observation period might be needed to detect whether increases in the theoretical constructs used in the intervention eventually lead to changes in behavior. According to the guidelines of Iran's Ministry of Health and Medical Education, as well as the educational content provided in this study, the Pap smear test can be performed at any point throughout the year. Therefore, some participants may have postponed screening beyond the two-month follow-up window, potentially affecting the observed outcome.

An important methodological consideration in interpreting the findings of this study is the potential for confounding by city. Since the intervention and control groups were assigned at the city level, with each study arm comprising only one city, the observed differences between the two groups cannot be attributed solely to the educational intervention. Potential differences between the two cities in terms of school environments, access to cervical cancer screening services, recommendations from healthcare providers, socioeconomic and demographic characteristics, and baseline screening-related experiences may have

influenced the study outcomes. Although improvements were observed in EPPM-related constructs and behavioral intention, these findings should be interpreted with caution.

Limitations

This study had several limitations. First, the non-random allocation of groups at the city level was a limitation, as potential differences in the cultural and socioeconomic contexts, as well as access to healthcare services between the two cities, may have influenced the intervention outcomes. Second, the use of convenience sampling may have resulted in the selection of participants who were not representative of the target population, thereby limiting the generalizability of the findings. Third, the exclusion of women who were in the danger control process not only reduced sample diversity but may also have affected the assessment of the intervention's effectiveness in translating intention into behavior. Fourth, the assessment of behavioral outcomes using self-reported measures may have exposed participants' responses to recall and social desirability biases, potentially affecting the accuracy of the findings. Therefore, future studies are recommended to use objective and verifiable measures to assess screening behavior more accurately, such as reviewing medical records, checking screening records in health information systems, and verifying the receipt of screening services through healthcare providers. Fifth, the two-month follow-up period may have been insufficient to assess sustained changes in health-related behaviors, as behavioral modifications often require a longer period to become evident. Sixth, individual and environmental factors, such as personal characteristics, social norms, and the lack of recommendations from healthcare providers, may have influenced participants' engagement in cervical cancer screening and potentially reduced the effectiveness of the intervention. It should be noted that the Extended Parallel Process Model (EPPM) does not directly account for these factors. Seventh, due to constraints imposed by the schools' pre-scheduled timetables, it was not possible to conduct additional educational sessions or extend the duration of each session, which may have affected the depth of learning and the effectiveness of the educational intervention. Finally, the present study focused on married female teachers working in schools in two cities, Islamabad-e Gharb and Sarpol-e Zahab. Therefore, the generalizability of the findings to other population groups and geographical regions should be approached with caution. Future studies are recommended to use larger sample sizes, longer follow-up periods, objective methods for assessing screening behavior, and multilevel intervention strategies to achieve more valid, accurate, and sustainable outcomes.

Conclusion

The present study suggests that educational interventions can play a significant role in changing health beliefs and behavioral intentions. Specifically, changes in the EPPM constructs indicate that the teachers developed a better understanding of the risks associated with cervical cancer and increased their self-efficacy to manage these risks. Furthermore, the shift from the fear control process to the danger control process observed in 43.3% of participants who received the program demonstrates the positive impact of the intervention in helping individuals make more constructive decisions when confronted with fear. Therefore, health communication and education providers should focus on interventions that enhance response efficacy and self-efficacy, alongside improving individuals' perception of threat. However, the low uptake rate of Pap smear testing after the intervention (1.7%) suggests that other significant barriers—such as time constraints, limited access to services, or cultural beliefs—may hinder the translation of behavioral intentions into actual screening behavior. Exploring these barriers is important for designing more effective interventions in the future. Indeed, adopting an integrated approach that combines the EPPM with other theoretical frameworks could be advantageous in addressing these challenges.

Abbreviation

EPPM: Extended Parallel Process Model; CVR: Content Validity Ratio; CVI: Content Validity Index; Q&A: Question and Answer

Ethics approval and consent to participate

The protocol of this study was registered at the School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, and was approved by the Research Ethics Committee of the Shahid Beheshti University of Medical Sciences (Ethics Approval Code: IR.SBMU.PHNS.REC.1394.6). As registration of this study in the Iranian Registry of Clinical Trials (IRCT) was not mandatory, the study protocol was not registered in this registry. To ensure compliance with ethical principles, participants were provided with comprehensive information regarding the study objectives, research procedures, and their right to withdraw from the study at any time. Written informed consent was obtained from all teachers before eligibility screening and baseline data collection. Participants were also assured that their personal information and collected data would remain confidential. Upon completion of the intervention, the educational materials developed for the study were also provided to the control group.

Consent for publication

Nothing to be reported.

In Press